



Clean, Efficient, and Reliable Heat and Power for the 21st Century

The need for clean, domestically produced energy has never been greater. The growing threat of climate change, America's dependence on imported oil, and the increasing need for innovation to remain globally competitive have come together to form a powerful imperative—one that demands new technologies and new approaches for the way we produce and use energy. Recognizing that the energy challenges facing the nation cannot be solved by any single approach, the Department of Energy (DOE) is developing a portfolio of technologies for energy production and utilization, including solar, wind, and geothermal energy; advanced biofuels; batteries for plug-in hybrid electric vehicles; and fuel cells.

Fuel cells have a potentially broad and vital role to play in our energy economy. They provide a highly efficient means for producing

Fuel cells are a highly efficient and fuel-flexible technology for producing power and heat. They offer significant benefits for a wide range of applications—including specialty vehicles (such as forklifts), distributed power systems, automobiles, buses, auxiliary power units, and portable electronics.

electricity from a number of fuels, including biomass, natural gas, propane, methanol, diesel, and hydrogen. And because they can be built to a variety of scales, fuel cells can provide power for distributed power systems, utility-scale generation, specialty vehicles (e.g., forklifts and airport baggage tugs), automobiles, buses, auxiliary power applications, and portable electronic equipment. Fuel cells offer significant benefits for a wide range of applications, with direct benefits for the end-user—including improved performance and reliability, and reduced lifecycle costs—as well as broader benefits for the nation—including reduced petroleum consumption, reduced greenhouse gas emissions, and a more secure, diversified energy infrastructure.

Fuel cells have gained traction in the marketplace for a few applications that are proven to be economically feasible and beneficial today, and they can be competitive in other markets, such as power for critical load facilities, where they provide unique

performance qualities. Continuing technological progress will allow fuel cells to compete in markets that have more stringent requirements in terms of cost, durability, and performance. The growth of current markets and expansion into broader markets will allow fuel cell technology to have significant economic and environmental benefits on a national scale.

Applications for fuel cells that are currently commercially viable or are expected to achieve viability in the near-term include: specialty vehicles (including material handling, airport ground support vehicles), backup power, auxiliary power units, primary-power systems, combined heat and power systems, and portable power. Although fuel cells used to power light-duty vehicles stand to provide the greatest benefits, they also face some of the steepest challenges, including: stringent technical requirements for fuel cell cost and onboard hydrogen storage; significant investment in infrastructure; and the need for large-scale and well-refined manufacturing



Fuel Cell Technologies Program



Fuel cells in a combined heat and power installation, using biogas

capability in order to compete with incumbent technologies.

Program Focus

The emphasis of the Fuel Cell Technologies Program is aligned with President Obama's priorities for improvements in energy efficiency and job-creation in the near term. The Program focuses on research and development of fuel cell systems for diverse applications in the stationary power, portable power, and transportation sectors.

Although fuel cells have already achieved some commercial viability, widespread market penetration will require further reductions in cost and improvements in durability.

To overcome these barriers, the Program's primary activity, Fuel Cell Systems R&D, will work towards key advances in a variety of technologies—including solid oxide, polymer electrolyte membrane, direct methanol, and alkaline fuel cells—that use diverse fuels, including natural gas, methanol, diesel, biomass-derived fuels, and others. The Program will continue to identify critical technology gaps to prioritize its R&D efforts as it advances fuel cell technologies for diverse applications, including:

- **Combined heat and power (CHP) systems**, where fuel cells can provide highly efficient, clean, and nearly silent operation, to further expand on the efficiency benefits inherent in distributed CHP systems.
- **Auxiliary power units**, where fuel cells can reduce fuel consumption and emissions in heavy-duty vehicles.
- **Portable power systems**, where fuel cells can provide a lightweight, longer-lasting alternative to batteries.
- **Stationary and backup power**, where fuel cells provide a clean, reliable, low-maintenance option for critical energy needs.

To help ensure that the benefits of advances in fuel cell technologies are fully realized, the Program will conduct rigorous analysis to quantify the energy efficiency, economic, and environmental benefits of fuel cells across multiple applications and fuel sources. These efforts will also seek



Backup power provided by a fuel cell



Forklift powered by a fuel cell

to identify and optimize synergies among fuel cell applications and other renewable technologies.

For More Information

Contact the EERE Information Center 1-877-EERE-INF or 1-877-337-3463 or visit www.hydrogenandfuelcells.energy.gov.



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